DOCUMENT RESUME

ED 396 716 IR 017 928

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TITLE Guide to Instructional Videoconferencing.

INSTITUTION Florida Univ., Gainesville. Inst. for Child Health Policy.

SPONS AGENCY Health Resources and Services Administration (DHHS/PHS), Rockville, MD. Bureau of Maternal and Child Health and Resources Development.
PUB DATE Oct 95
CONTRACT MCJ-127413
NOTE 19p.
PUB TYPE Guides - Non-Classroom Use (055) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Computer Mediated Communication; *Computer System Design; *Delivery Systems; Distance Education; Instructional Design; *Telecommunications
IDENTIFIERS Connectivity; Interactive Systems; *Video Teleconferencing

ABSTRACT

An instructional videoconference (IVC) is an interactive delivery mechanism for long-distance communication and education, which uses 2-way audio and 1- or 2-way video to facilitate interaction between presenters and learners who are separated by significant distance. This guide, intended for the staff of federal, state, and local programs that serve mothers and children, illustrates the basics of instructional videoconference production. A definition of IVC is provided, including linkage, interactivity, and crucial factors to consider when deciding whether or not to choose an IVC. Discussion then focuses on: instructional design goals; demographics and audience description; four types of delivery systems (satellite, cable, microwave, and digital telecommunications via phone lines or fiber optic systems); and costs. The steps involved in producing an IVC are also described and include: identifying a need; establishing a goal; determining a timetable; and developing a team which incorporates a content specialist, producer, instructional designer, audience specialist, and delivery system specialist. An example is provided of how an IVC may be achieved by marrying different delivery systems and technologies. (AEF)

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GUIDE TO INSTRUCTIONAL VIDEOCONFERENCING

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This guide was produced by the Institute for Child Health Policy
with support from the Maternal and Child Health Bureau,
Health Resources and Services Administration,
U.S. Department of Health and Human Services (Grant MCJ 127413).

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OCTOBER 1995

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INTRODUCTION

This guide is for the staff of federal, state, and local programs that serve mothers and children. The Institute for Child Health Policy (ICHP) has produced this guide as an introduction to help you to understand how the Instructional Videoconference (IVC) is developed. If you need to communicate with and train a large number of geographically dispersed individuals who will need to interact with one and other, instructional videoconferencing may be the most efficient and cost-effective format available to you.[1]

Although the effort involved is considerable, the training benefits can be great. The well-designed IVC provides live, simultaneous, quality controlled, low-cost training for hundreds of participants. In addition, the IVC generates a new training product when the IVC is videotaped and edited. This edited version of the IVC may be enhanced by an accompanying user's guide. A VHS tape and user's guide may be distributed easily, and this curriculum may be used for small group training and self-paced instruction. The technology is also available to convert the edited IVC video and user's guide into an interactive CD-ROM to provide a multimedia instructional tool for self-paced, computer-based instruction.[2]

The potential training payoff for producing an IVC is great. This guide will help you get up to speed on the basics of IVC production and will help you:

1. Decide if an IVC can be useful in meeting your instructional and communication goals.
2. Determine if your organization has the staff and resources to implement an IVC.
3. Oversee the process of producing an IVC.

WHAT IS AN INSTRUCTIONAL VIDEOCONFERENCE?

Definition:

An Instructional Videoconference is an interactive delivery mechanism for long-distance communication and education, which uses 2-way audio and 1- or 2-way video to facilitate interaction between presenters and learners who are separated by significant distances.

Linking:

An IVC electronically links presenters with learners located at dispersed sites. The electronic link may take many forms and combine many technologies like satellite transmission,

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1 This guide is based on the premise that you are considering a large-scale IVC involving at least 200 participants, rather than an interactive video meeting that includes fewer than 10 people per site.

2 It is predicted that within the next 2-5 years CD-ROM players will become as common in workplaces as VCR's are now.

microwave transmission, and/or compressed digital transmission over telephone lines. Whichever technology you use, the ultimate product is a televised presentation.

Interacting:

The essence of videoconferencing is interactivity. This interaction allows participants to question the presenters and the presenters to answer these questions. How you choose to transmit the questions may vary from full 2-way aural and visual communication by satellite or phone lines to the presenters receiving questions by telephone calls, e-mail, or faxes during the live presentation. Regardless of how the questions are asked, participants can ask and presenters can respond live during the presentation.

Is an IVC the Right Approach?

Deciding whether or not to choose an IVC for your training and communication need depends on several crucial factors:

Instructional Designer's Goals:
What instructional goals do you need to accomplish?

Demographics & Audience Description:
Who are your learners and your presenters? How many individuals are involved? What are their professional backgrounds and previous knowledge levels? Where are they located? Are they familiar with videoconferencing?

Delivery system:
Which transmission technology or combination of technologies is best suited to your needs? Which delivery systems are most readily available to you?

Costs:
What are the overall and per capita costs and how do these costs compare to other forms of delivering your instruction? A framework for considering each of these four factors is provided in the following sections.

INSTRUCTIONAL DESIGN GOALS

Can your instructional design goals be met by Instructional Videoconferencing?

In considering the appropriateness of any instructional medium for your instructional goals, the distinctive characteristics of your communication/instructional materials and the medium

must be considered. The distinctive characteristics of the Instructional Videoconferencing format include:

- Capacity to reach large numbers of distant and dispersed learners
- Capacity for learners and presenters to interact during the IVC
- Capacity to emphasize visual components of instruction

In evaluating the appropriateness of the IVC medium for your instructional goals, you should match your instructional design objectives with the characteristics of the IVC medium. You should ask:

Do we need to reach a large, geographically dispersed audience?
In determining the cost effectiveness of an IVC a major consideration is the number of individuals who will be participating in your training conference and their geographic distribution. For example, travel costs for a one-time training or conference could easily exceed the cost of producing and delivering an IVC if hundreds of participants are dispersed over hundreds or thousands of miles. Similarly, the expense of having national experts travel to many dispersed sites to conduct separate trainings could exceed the cost of producing and delivering a single IVC.

In addition, the need to continually upgrade the skills and knowledge of maternal and child health care providers, social service providers, and other professionals serving maternal and child health care needs often conflicts with demanding workloads. Videoconference training offers a solution by providing training that features experts at sites convenient to the workplaces of the participants.

Do our participants need to interact with the presenters?
If you want participants to be able to ask questions of expert presenters, you need a system that allows for two-way interaction. Ideally, all participants would both see and hear each other, but this two-way audio-visual technology is not widely available. However, by coupling the transmission of an audio-visual presentation with a toll-free 1-800 telephone number and multiple in-coming phone lines, you can efficiently and economically achieve a two-way interaction. Learners may also e-mail and fax questions to the presenters during an IVC. The learner's interest is stimulated by hearing questions from other learners and seeing graphics showing a caller's location. Seeing other participants asking questions also stimulates the participant's willingness to pose his or her own questions.

Does the message have a visual component?
You can best convey many aspects of instructional content visually by graphics, illustra-

tions, photographs, and video. Presenting processes and procedures so that they may be visually observed and modeled by learners is an effective instructional approach. You may want to use case studies portrayed through video to reveal salient aspects of a process or a procedure.

Eye contact and body language of the presenter may affect the efficacy of instruction. By carefully choosing angles and shots, a television studio director can enhance the instructor's presentation. Interaction among expert panelists also enhances the learners' interest in the exchange.[3]

Often presenters have previously prepared visual information in the form of overheads, slides, and charts. This visual information may be crucial to what your expert has to say. By preplanning and getting help from the television graphics person or the director associated with your production facility, you can ensure that all graphics and visuals look good for your videoconference.

DEMOGRAPHICS AND AUDIENCE DESCRIPTION

Once you have identified the content of your training you should consider these key questions about your potential learner/participants:

Who are the learners?
Who are the professionals and families who need to be reached with this information and training? Will your audience be multidisciplinary? Do you have good liaisons with the professional and/or lay groups that will be represented?

How many individuals do you plan to reach?
The emphasis of this guide is on large-scale IVC's that will involve hundreds of participants. In general, the more individuals you plan to reach, the more cost-effective the IVC. There are, however, small and large scale video conferences that use phone lines to aurally and visually link participants.

Where are your participants located?
Are they spread across a state, a region, or the country? The location of your participants coupled with the availability of downlink sites where they can receive the IVC will greatly influence your delivery system.

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3 For detailed discussion of graphics for television see Television Production Handbook by Herbert Zettle (see full citation in references).

What are your participants' learning preferences?
In general, adult learners prefer self-directed learning. Some adults feel uncomfortable in a structured group learning session. Others, however, appreciate the structure. You may already have information about the learning styles of professionals you are targeting. This type of information may help you determine whether the IVC will be an effective format for your learners and how to adapt the IVC format for them. This information may also help you to decide what type of presentations to include in the IVC. For example, showing a video of a process in a real setting with close-ups and proper sequencing, creates very effective demonstrations and teaches technical skills. Similarly, videotaped case studies that familiarize the learner with details of specific family health care situations are a powerful learning tool.

Is there an individual at each site who can serve as a site coordinator?
Your participants will get the most out of the videoconference if someone at each site can facilitate the training for the other participants. Choosing the best site facilitator is crucial. She or he will be a leader among those whom you target for your IVC. This individual should be enthusiastic about the training. She or he must truly believe that the training will be beneficial to the participants. In addition, the site facilitator should be well-organized and responsible.

The site facilitator should be familiar with the issues and concerns of the participants and receive advance training about the videoconference's format and content, and about facilitating responsibilities. Also, the site coordinator will arrange for the downlink site and will take responsibility for coordinating the logistics of the site. She or he will coordinate with a technical person at the downlink site to make sure the signal is properly received.

DELIVERY SYSTEMS

There are four types of transmission options for sending your IVC to far-reaching sites: satellite, cable, microwave, and compressed digital over telephone lines or fiber optics systems. Currently, satellite transmission is the most accessible option, however the others are mentioned because in some regions these methods of transmission may be preferable.

SATELLITE:

With this technology your presentation is transmitted from your central site to a receiver on a satellite. The signal is then downlinked or transmitted to a ground receiver as a signal that can be received by any satellite dish that is tuned to receive the signal's transmission frequency. This technology allows for transmission over the entire U.S. and even internationally. The area that can potentially receive the downlink signal is referred to as the "footprint." The geographic limitations of this area depend on the location of the satellite you are using.

You may have access to government-leased satellite equipment. Check with your Department of Education, Department of Health, or other appropriate agencies of the government to determine if satellite facilities are available through your government affiliations. If you do have this access, your satellite rental rates could be much lower. If not, you may rent satellite time from a private company. Companies that rent satellite time abound. Other needs may include putting your signal in two frequencies for transmission on two satellite reception systems, Ku-Band and C-Band. If among your participant downlink sites there are both types of receiving equipment, transmission of both signal frequencies will be necessary.

Satellite time is rented on a first come, first served basis. You must schedule peak transmission times (i.e., the middle of the business day) well in advance. You may shop around for the best per hour rental rates by contacting satellite rental companies and telling them your exact needs. Ask them to bid on your project. Prices for satellite rental can range from around $800 per hour to more than $1,000 per hour depending on time of day of the transmission and technical requirements.

CABLE:

Most cable companies are capable of designating a channel to be the carrier of a video conference. In some areas, cable companies have designated educational channels. Cable transmission can reach within the immediate region. However, it will not reach learners outside of the cable service area. Also, the option of interactivity is often omitted from these cable transmissions.

MICROWAVE:

Microwave is a terrestrial, line-of-sight transmission. A signal is sent from one microwave antenna to another. People in the western states use microwave facilities more widely because microwave antennae may be placed at high elevations, and signals may be transmitted from one microwave antenna to another over great distances without obstruction. Unlike a satellite downlink, a microwave signal goes only to one site at a time. If the microwave goes to a cable distribution system, the signal can be disseminated via cable to multiple sites.

DIGITAL TELECOMMUNICATIONS VIA PHONE LINES OR FIBER OPTIC SYSTEMS:

This technology sends the output of a television studio or televised classroom (which is in the form of a wave, referred to as an analog signal) through a system that converts the wave into digital video and audio information.[4] This digitized signal can be transmitted on phone lines or, if available, through fiber optics to receiver sites if the necessary technology is in place. The cost of this form of transmission can be much less than that of satellite transmission.

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4 A codec, COder-DECoder converts analog signals into digital form. When analog to digital conversion is part of your transmission configuration, two codecs are needed, one at the sending end and one at the receiving end.

Your Challenge—Identify Technical Experts

As a nonexpert, your major challenge is to identify individuals who know the distance learning transmission options in your region. These individuals may be health educators who have used distance learning systems or people with technical expertise in distance learning. They may be affiliated with community colleges, medical schools, teaching hospitals, the Department of Health or the Department of Education. These experts should be familiar with the options available in the region. They will know what facilities exist at universities, community colleges, corporations, state and county extension service facilities, and other entities that routinely produce distance learning. These experts can help you determine which transmission system will best meet your needs.

COSTS:

While the total costs for your IVC will depend on your specific needs, the following example provides a ball park idea of costs. This example is based on these specifics:

- A 3-hour IVC with one central site of origination where your presenters will be congregated.
- Using a satellite to transmit your IVC to sites all over the U.S.
- Five expert panelists.
- Ten minutes of original video to illustrate your content.

The following costs are rough estimates. Remember, costs vary widely depending on various factors like the expertise of your staff and your location.

Budget Estimate:

	Low	High
Technical & production consultants (e.g., 10-100 hours @ $30-$100 per hr.)	$ 300.00	$10,000.00
Renting 3 1/2 hours of satellite time (ranges from $800-$1000 per hour)[5]	2,800.00	3,500.00
Bringing 5 presenters to IVC origination site (@ $600-$1,200 ea.)	3,000.00	6,000.00
Creating or adapting graphics for TV	200.00	1,000.00
Producing and copying printed instructional materials	300.00	2,000.00
Creating instructional video	4,000.00	10,000.00
Renting production facilities and crew for one 8 hr day	2,500.00	9,000.00
Total—Ball-park budget range	**$13,100.00**	**$41,500.00**

In some cases, as the organization offering the IVC, you may also be responsible for

5 Rates for satellite time rental are rising rapidly. Before creating your budget, check current rates.

defraying costs at the sites where the IVC is received (i.e., downlink sites). Although these costs vary depending on the sites and your arrangements and affiliations with these sites, costs tend to average $100-$200 per hour.

In many cases there will be no need to produce any original video for the conference. Your presentation may not require video or you may be able to use a previously produced video for your conference. Without this expenditure, your costs may be $4,000 to $10,000 less. Obviously, the more participants, the more reasonable your overall cost becomes. For example, if the total price tag for an IVC is $30,000, with 500 participants the cost of this training is only $60 per person.

STEP-BY-STEP

The following are steps involved in producing an IVC. You will find these steps similar to those you would follow in creating any instructional presentation. For example, your organization will identify a need for this presentation and from that need you will derive goals and objectives. You will identify who among your staff can carry out the tasks associated with producing an IVC. Once you have assessed your in-house capabilities for producing the IVC, you will be able to assess what outside expertise may be necessary.

Identify a Need:

Whether you identify this need through a formal or informal assessment process, the individuals you are targeting with your IVC must share a perception that they need the information/training/instruction that you are providing. This perceived need may result from their own professional experience or from a mandate they must fulfill. Without this perceived need it will be difficult to engage their enthusiastic participation which is essential for a successful IVC.

Establish a Goal:

Once the need is established, you must develop a clear statement of the overall goal. This goal will probably emerge from identified needs. As discussed earlier, this goal must mesh with the characteristics of the IVC format—i.e., you want to target large numbers of geographically dispersed individuals, you want interactivity, and you must convey visual information.

Determine Timetable:

What date and hour will your IVC be transmitted? This single detail becomes the organizing point for all the activities that follow. Whatever your circumstances, you must begin with a target date. If you plan well in advance, your IVC will be the first thing on the participants' calendar. The same is true for renting facilities such as a studio and satellite time.

AN EXAMPLE OF THE MARRIAGE OF IVC TECHNOLOGIES

Here's a good example of how an IVC may be achieved by marrying different delivery systems and technologies.

The Institute for Child Health Policy produced an IVC for public health nurses in the Department of Health and Human Services (DHHS) Regions VIII, IX, and X, which includes 14 western states. More than 500 public health nurses participated.

The purpose of the IVC was to help public health nurses become familiar and involved with the early intervention process required by Public Law 99-457, Part H (Part H promotes a family centered, team approach to providing services to infants and toddlers [0-3] with special health care needs.).

We wanted all the public health nurses to be able to ask the presenters questions so we provided an 1-800 phone number during the IVC. We also wanted some participants to be visible as they asked questions and responded to comments. The purpose of having some participants visible in two-way interaction was to model active participation among all the learners. We found an entire system of two-way interactive classroom sites equipped with voice activated cameras and microphones in Wyoming. This system translates the picture and sound waves produced by television cameras into digitized information that is transmitted via phone lines to various sites. But this is strictly an in-state system. In Wyoming there was no system up-link (a system for transmitting a television signal up to a satellite) to transmit out-of-state. Our IVC needed to reach from Hawaii to Alaska to Washington, DC, but without a satellite uplink there was no obvious way to transmit the picture and sound from Wyoming classrooms to satellite.

However, by asking a lot of questions, we found out that only 50 miles from Laramie, Wyoming, in Fort Collins, Colorado, Colorado State University has a fully equipped distance learning facility including an uplink. Now all we had to do was get the output of the phone line's digital signal of the Wyoming classrooms from Wyoming to Ft. Collins. We found the missing link in the form of a microwave transmitter in Laramie. In Laramie our digital phone signal could be converted to a wave signal and sent down to Ft. Collins to another microwave antenna. This signal was then transmitted to the studio in Ft. Collins, where this audio and visual transmission of the Wyoming classrooms was incorporated into the live presentation of our presenters in the Ft. Collins studio. The composite was sent up to the satellite to be transmitted to sites all over the country.

Our experience of using digitized signals over phone lines, satellite transmission, and microwave is only one example of using existing systems as well as marrying technologies to achieve your communication goals. In today's diverse technological world many interfaces are possible. For the novice IVC producer, the important thing is to keep your vision in mind and seek answers from the experts until your goals are met.

You will also want to decide how long your instructional video conference will last in order to plan for facilities including the satellite rental time. Three to 3½ hours seems to be the limit of time audiences can comfortably attend to an IVC, and this includes a 15–30 minute break. You may want to suggest to site facilitators that they include time prior to the actual transmission of the IVC for face-to-face instructional activities.

Lead Time:
The team will need to establish a timetable early in the process and this will vary according to the complexity of the IVC. For example, if the curriculum is already developed and only needs to be adapted to IVC format, you will require less lead time than if the curriculum still has to be developed. You may decide to include video segments that need to be preproduced and this will also take sufficient lead time.

Staff Support:
The amount of lead time you will need depends on your staff support, budget, and experience. For example, when the Center for Disease Control produces a video conference, they rely on an in-house team of five individuals who have a great deal of past experience. This team generally spends six months preparing for the IVC in addition to fulfilling other commitments. If your team is small and inexperienced, or your IVC involves a great deal of preparation, you may need to give yourself 12 months of lead time. However, even if you don't have the experience, you may be able to produce an IVC more quickly because your content is ready to go, the audience is ready and waiting, experts may be easily lined up and committed to participate on short notice, and the budget can handle the expenses that may be incurred from having to do things quickly.

Develop a Team:
The next step is to determine which individuals will handle specific tasks involved in producing the IVC. You must also determine the tasks that must be delegated to outside experts. Most organizations opt to contract with outside specialists for some IVC-related services. You may find expertise in IVC production and transmission at media support centers affiliated with colleges of medicine or schools of allied health, in public television stations, state Departments of Education, as well as in private companies. Outside specialists may be contracted to handle most of the arrangements for the IVC or simply the technical elements. Regardless of whether or not the responsibilities for tasks are delegated in-house or contracted out, five roles must be carried out to achieve your IVC. These roles are: content specialist, producer, instructional designer, audience specialist, and delivery system specialist. You may have a separate individual who can handle each of these areas of responsibility or you may have some individuals who can take on more than one of these areas.

One person must be designated as the leader. Often this individual is the producer. However, if the producer is not an in-house person, another individual may take the lead. In addition to these on-going roles, an experienced moderator will be needed for the actual videoconference and as well as site facilitators to supervise each downlink site on the day of the broadcast. The following descriptions of these roles should help you to identify the individuals you will need to recruit.

Content Specialist:
This individual is very knowledgeable about the information, training, and instruction to be imparted. She or he will work with the instructional designer to determine what information must be included and how to prioritize and present that information.

Producer:
The producer is responsible for the ultimate product, the IVC. This individual works with the entire team to bring the instructional content into the IVC format. The producer will help select and bring the experts to the television studio or other location from which the televised presentation originates. She or he will audition a moderator, be responsible for coordinating and, if necessary, producing all visual components, and coordinating with the delivery system specialists to bring the IVC to the participant. The producer will also write a script outline or obtain the services of a script writer, director, and other television crew specialists. The producer may also be responsible for all aspects of the budget unless your organization includes a financial specialist who assumes the budgetary duties.

Instructional Designer:
This individual should make a major contribution to the initial decision to produce an IVC. He or she will help determine whether or not an IVC is an appropriate format for the content to be presented. The instructional designer has expertise in structuring the content for the training and instruction to maximize learning potential. This person will be familiar with the characteristics of the IVC format and will know how to shape the material to best take advantage of the IVC format's strengths.

Audience Specialist:
This individual will be familiar with the targeted participants and will have or develop the contacts to tap into professional networks that include these participants. Ideally, the audience specialist will already know the potential participants, how to reach them and how to cultivate their optimal participation. The audience specialist will identify individuals who can take responsibility for facilitating the IVC at downlink sites. The audience

specialist may also identify and make arrangements for the use of sites that are equipped to downlink or receive the IVC. He or she may also be responsible for developing a guide to help site facilitators carry out their tasks.

Publicity and notifications about the IVC describing content, when it will be transmitted, how it can be received, and if applicable, registration information, must be disseminated. The audience specialist may also be responsible for the prepublicity of the IVC, either directly or by delegating to a publicist.

Delivery System Specialist:

This person knows how to connect your IVC to the participants through the delivery system that is most appropriate to your needs. This person must be familiar with the delivery options available to you and will advise you as to which system will best meet your requirements. This individual will also help arrange for the delivery system and be available to follow through on the technical support related to that delivery through the IVC. The delivery system specialist may be employed by an organization that routinely conducts distance learning, and may have an engineering background or access to individuals with engineering expertise. This specialist should be able to help you decide which technology in which combinations will best suit the delivery needs of your IVC.

Moderator:

Most IVC's will benefit from the services of a professional television moderator. This individual should have experience appearing live, on-camera, and with moderating panels of people. A television news anchor is often chosen for this role. He or she will be entirely comfortable in front of the camera and help presenters who are less experienced in a television studio to feel at ease. His or her presence will create a well-controlled, professional tone for the IVC.

Site Facilitators:

The audience specialist will be in the best position to identify individuals from the down link regions who may serve as on-site facilitators for the IVC. For example, if you are conducting a training for public health nurses, a nursing supervisor or regional coordinator may be willing to receive the handout materials in advance and administer and be responsible for pre- and post-tests to evaluate participants' learning. She or he may be asked to present background material prior to the video conference and lead small group discussion. This individual should be comfortable in a leadership/training role and motivated to help make the videoconference an instructional success. An effective way to prepare site facilitators is through one or more conference call training sessions.

Outside Contractors:

You can determine which services you will need from outside contractors only after you have assessed what can and cannot be done in-house. You can contract for almost any part of the process. There are commercial and public organizations that will handle every aspect of the IVC from instructional design to transmission to evaluation. The most commonly sought expertise is for delivery systems specialists, production consultants, and the moderator. You may also contract with professionals who can identify and organize a network of downlink sites where your IVC will be delivered.

IN CONCLUSION

We recognize that each individual and organization preparing to produce an IVC will have different needs. Therefore, we have approached the information presented in this guide from a generalist's point of view. If, however, you are on the road to building your own expertise in Instructional Videoconferencing, you will want to delve into this subject in much greater technical detail. Hopefully, this guide has served as a useful introduction to the process and will see you on your way to becoming a successful IVC producer. The references for this guide also point you to more detailed information sources.

The Institute for Child Health Policy can provide technical guidance in telecommunications activities to selected state Title V programs. In addition, ICHP offers consultation in the production of instructional videoconferences on a contractual basis. Please contact us if we can be of any assistance.

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GLOSSARY

ANALOG—Information presented by a continuous electromagnetic wave from a sound or light source. An analog signal is a continuous wave as opposed to a digital signal which conveys audio and light information in a series of discrete intervals or steps.

BAND WIDTH—The range of cycles per second (from low to high) of electromagnetic waves (known as frequencies) of a transmission channel.

C-BAND / KU-BAND—Domestic communications satellites operate on two frequency ranges, C- and Ku-band. Each requires specific electronic equipment. C-band is less expensive. Some IVC's are broadcast on both bands.

CODEC—A Codec-DeCoder converts analog signals (voice or video), into digital form.

COMPRESSED DIGITAL—The application of any of several techniques that reduce the amount of digital information required to represent that information in data transmission. Compression reduces the amount of band width necessary to transmit the information.

DIGITAL—Information represented by signals encoded numerically as a series of discrete steps or intervals. Can be converted to be sent over wire or air.

DOWNLINK—Retransmitting a signal that has been received by a satellite from a single earth station from the satellite over a wide geographic area to receiving earth stations.

DOWNLINK SITE—An earth station with a receiver dish tuned to pick up a signal being sent from a satellite.

E-MAIL— A system of electronic communication whereby an individual sends a message to another individual or group of people—usually refers to computer mail.

FREQUENCY—The number of times a complete electromagnet wave cycle occurs in a fixed unit of time (e.g., one second).

FIBER OPTICS—Communications medium based on a laser transmission that uses glass or plastic fiber which carry video or audio signals that have been converted into light pulses.

FOOTPRINT—Earth coverage area that a satellite can broadcast to.

GIGAHERTZ (GHZ)—An electromagnetic wave that cycles at 1 billion cycles per second.

GROUND RECEIVER—Converts satellite signal into channel viewed on a TV monitor, located on earth.

HERTZ (HZ)—Basic measure of frequency with which an electromagnetic wave completes a full cycle from its positive to its negative pole and back again. A single hertz is equal to one cycle per second.

INSTRUCTIONAL VIDEO CONFERENCE—an interactive delivery mechanism for long-distance communication and education, linking presenters and learners separated by significant distances, using a 2-way audio and 1- or 2-way video to facilitate interacting between presenters and learners.

MEGAHERTZ (MHZ)—One million electromagnetic cycles per second.

MICROWAVE—Line of sight transmission of high frequency signals using microwave transmitter and receiver dishes.

RECEIVER—Converts satellite signals into channels.

REPEATER—A device for strengthening a weak signal before sending it on to a more distant service area.

SATELLITE—An electronics retransmission device. Normally placed in geostationary orbit around the earth for the purpose of receiving and retransmitting electromagnetic signals.

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